

Example 6:

- (a) Determine the stable parking orbit velocity for a surveying satellite located 230 km above the moon's surface.

orbit \Rightarrow circular motion $\therefore F_c = F_g$

sub. in formulas $\frac{mv^2}{r} = \frac{GMm}{r^2}$

$$v = \sqrt{\frac{GM}{r}}$$
$$= \sqrt{\frac{(6.67 \times 10^{-11})(7.35 \times 10^{22})}{[(1.74 \times 10^6) + (230\,000)]}}$$

$$v = 1.58 \times 10^3 \text{ m/s}$$

- (b) If that orbital radius were reduced by one-tenth, by what factor would the orbiting speed increase?

$\rightarrow \frac{1}{10}$ less means $r_{\text{new}} = \frac{9}{10} r_{\text{old}}$

\rightarrow looking at $v = \sqrt{\frac{GM}{r}}$ (see above),

$$v \propto \frac{1}{\sqrt{r}}$$

$$\rightarrow \text{So } v_{\text{new}} = v_{\text{old}} \left[\sqrt{\frac{r_{\text{old}}}{r_{\text{new}}}} \right] = v_{\text{old}} \left[\sqrt{\frac{r}{.9r}} \right]$$

$$v_{\text{new}} = 1.05 v_{\text{old}}$$